COMBAT READINESS AND CAREER PATTERNS OF NAVAL AVIATORS

JACK B. ANDREWS

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by

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The complexity of modern aircraft and the vast advances in technology resulting from the technological explosion in weapons delivery systems create a major problem for the professional naval aviator. In an effort to solve this problem in the limited field of the Attack Carrier Striking Force naval aviator, the career pattern trends in industrial and educational fields have been analyzed. The present career pattern of the Attack Carrier Striking Force naval aviator has been analyzed and it has been weighed against the combat readiness status desired of these naval aviators. A comparison of a World War II, fighter aircraft,a post Korea fighter aircraft, and a modern day fighter aircraft, and a discussion of present day high speed flight problems reveal the extent of technological advances in this field. The educational and training requirements for professionalism in this field are discussed. Finally a program is outlined that would aid in attaining the professionalism required in this field for the maximum combat readiness that is desired.

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COMBAT READINESS
AND
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by

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INTRODUCTION

In this era of "Cold War" and "Brink of War" tactics in international relations the United States must maintain its military forces in a constant state of maximum combat readiness. Any relaxation from this maximum readiness status is an open invitation for Premier Krushchev to proceed with his avowed intentions to "bury" us!

One of the prime components of our military forces is the Naval Striking Force. The mobility and versatile power of the Striking Force make it an ideal instrument for enforcing national military policy. Even in peace time, unsettled world conditions require attention. The existence of a striking force can serve as a stabilizing influence to prevent the outbreak of hostilities. If hostilities should occur in spite of diplomacy and other means of settling international disputes, the striking force is available at once for the prompt and decisive action which may be necessary. Mobility - the greatest asset of a striking force - permits surprise attacks at any point on the periphery of an enemy land area bounded by navigable waters and forces the enemy to spread his forces on the defensive, thus denying him the initiative.

Technological improvements have multiplied the power and extended the range of the attack carrier striking force, first developed by the Navy in the early 1920's and brought to a high stage of perfection as

the Fast Carrier Task Force during World War II. Essentially the Attack Carrier Striking Force, supported by an underway replenishment group, constitutes a mobile air base which can be moved within effective striking range of many appropriate enemy targets. Its offensive and supporting capabilities have reached an exceptionally high degree of effectiveness.

Carrier based aircraft are the principal weapons of an attack carrier striking force. These aircraft are of three major types; light attack, heavy attack and fighters. For the most part these aircraft are, or will be, high performance jets. Their primary mission is offensive air action - strikes against designated objectives in order to establish and maintain local air superiority; neutralize enemy bases; interdict enemy transportation and communications; and give tactical air support to amphibious and surface-action operations. Secondary missions for carrier based aircraft are air defense, AEW, ASW, photo and weather reconaissance, search and rescue, and electronic countermeasures.

The men who man these aircraft determine, for the most part, how effective our Attack Carrier Striking Force will be. No matter how capable the aircraft is, its effectiveness as a weapons system is determined by how well the man controlling it utilizes it. It is the aim of this paper to investigate the relationship between the career patterns of these men and their combat readiness and to recommend possible improvements to career pattern programs so that the combat readiness of naval aviators manning Striking Force aircraft may be maintained at the highest possible level.

THE NEED FOR PROFESSIONALISM

Chief of Naval Operations, Admiral George Anderson in a recent article made the following remarks, "First, I desire that each man know his job and do his duty. And I don't mean by this that a man know 95 per cent of his job and perform his duties 95 per cent of the time. That isn't enough today." He went on to say, later in the article, "I want all our men to use their inherent mental capabilities to the utmost and to do everything possible to improve their minds. There was a day when the effectiveness of a man-of-war depended to a great extent on the strength of a man's back - but today, physical strength has given way to mental strength. The Navy needs bright - alert - intelligent men who are mentally equipped to meet the complicated demands of the future".

The watchword of Naval Aviation is professionalism. Webster defines a profession as "a vocation or occupation requiring advanced training in some liberal art or science, and usually involving mental rather than manual work"; his definition of a professional is, "One having much experience and great skill in a specified role."

PROFESSIONALISM AND SPECIALIZATION

"Professionalism" is also becoming a watchword in education and industry. Specialization and sub-specialization is blooming on all sides. The medical profession is an excellent example of the trend to and demand for specialization. We find the general practitioner increasingly harder to find, since he is being replaced by the specialist. These specialists are popularly grouped in a medical clinic and often a person who is ill will be referred to three or four or more doctors before the illness is finally diagnosed. This specialization has served mankind well since it allows a field that can properly be mastered by one man. The educational field has wisely required a broad general medical education as a base for the specialized fields.

In the education field what was formerly a major field in the sciences has been greatly subdivided. No longer does a student major in what has become a broad field of chemistry, physics, or biology. Scientific progress and the technological explosion of the last twenty years has required the birth of new fields such as nuclear physics and bio-chemistry. Even the honored field of mathematics is spawning sub areas. The U. S. Naval Postgraduate School has this year established a new department of Operations Analysis. Many of the large industries support educational institutions; several of the giant corporations have even established universities of their own. General Motors is one of these firms and a glance at the curricula of the General Motors Institute of Technology will indicate the trend to the necessary sub-specialization that is required to support present day industrial life.

New professions are emerging as a result of this trend to specialization. Management consultants are prominent in any industrial area. Organization and administration specialists are employed by many large corporations. Statisticians and operations analysts are filling an important need in many areas. The traditional salesman now appears in different sub areas such as the sales engineer, market analyst and promotion specialist. One of our major present day problems is what to do with the general laborer, a non-specialist who is fast becoming "unemployable."

The fact that the economy and industry support this sub-specialization is proof that it is necessary. The profit motive will not long endure any unnecessary frills. The breadth and depth of the phenominal scientific and technological advances require that fields be narrowed so that man can master a particular field. Even the social sciences, always slow in adapting, are beginning to sub-specialize in areas such as industrial psychology and behavioral psychology.

In recent years there has been much concern about language barriers between the sub areas. We have all heard the technical specialist on a quiz program talk in his trade jargon. To the uninitiated it is unintelligible gibberish. With the advent of computers this problem is becoming even more critical since the computer can be a great aid in nearly any field. The communications problem here is compounded by the fact that not only two different areas must have a compatible language but that language must also be compatible to the computer. A great deal of work is being done in this language area. The latest efforts are in

attempting to quantify all areas as much as possible. Note here that there is no tendency to compound many sub areas into one but the effort is to develop suitable communications between the fields.

SPECIALIST TO GENERALIST

Now let us consider, for a moment, the executive class in our business life. The corporate executives stem from all walks of life, but one thing nearly all have in common; they were at one time specialists, either engineers, sales specialists, lawyers or administration experts. Congress is a good example of this trend. The business of Congress is making laws and better than three fourths of our Congressmen were and are lawyers. The statement then, that the majority of the executive class are generalists that emerged from a specialist area, appears to be valid.

The Navy's enlisted structure follows the specialist to generalist path with excellent results. After a "boot camp" indoctrination the enlisted man selects and strikes for a rate in a particular sub area. He remains in this narrow sub area, mastering it as he progresses upward. At the first class and chief petty officer level he then is required to broaden his knowledge to encompass the whole of the parent area and the administration functions that such a broadening requires.

THE PRESENT NAVAL AVIATOR CAREER PATTERN

With the foregoing comments in mind let us consider the career pattern of a typical striking force naval aviator during his first fifteen years which would bring him to commander selection point. His first tour will be with an operating squadron. He will arrive with

three to four hundred hours of flight time and within six months to a year will be qualified to carry out most operational missions. The reticence of all weather type squadron commanding officers in desiring only the outstanding flight training graduates indicates the difficulties which often attend this stage of a flying career. In fact the command decision rendered in manning the recently formed F4H squadrons was that all reporting naval aviators were to be "second tour" pilots who had successfully completed this original fleet tour.

The next three year tour will be spent in either the Training Command, the General Line and Naval Science School or assigned to aviation activities of the Shore Establishment. To be more specific:

> "74% of the officers rotated ashore will be assigned to the Training Command, General Line School, and Colleges, either as instructors or students. The remaining 26% will be assigned to aviation activities of the Shore Establishment. The majority of billets in the training command are operational flying assignments thereby providing maximum opportunity for an aviator to enhance his operational skill."[1]

I take exception to the statement that the majority of the training command assignments provide maximum opportunity for an aviator to enhance his operational skill. I would qualify this statement by saying that only in the Advanced Training Command type flying billets can the striking force naval aviator maintain anything close to a "combat ready" status, and these billets are definitely a small minority of the training command billets. I personally served in a Basic Training Unit where the training load was so heavy that even the annual

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[1]United States Bureau of Naval Personnel, Officer Fact Book, (NavPers 15898) page 8-28. (See Appendix A).

instrument requirements for the instructor pilots were waived. Assignment to a school automatically brands a naval aviator as a "proficiency pilot" and limits him to from 90-100 flight hours per year. In this status only a bare instrument qualification can be maintained.

The remaining 26% assigned to aviation activities of the Shore Establishment are too varied to consider in detail. I am safe in stating, however, that only in rare instances can a Striking Force naval aviator maintain a "combat ready" status while attached to these billets.

With the scarcity of squadron billets the next four year tour has become a split tour with two years spent in an operating squadron and two years in a ship, staff, and/or overseas billet. The two year squadron tour commences with a six month Replacement Air Group retraining cycle during which the aviator is given intensive training to return him to fleet standards. A few months after reporting to the operating squadron the reporting aviator is again "combat ready." The two years of duty in a ship, staff, and/or overseas billet is again a minimum proficiency type flying period either because of duties or funds or both.

The next shore tour is the Advanced Educational Phase:

> During this tour approximately 37% of the officers will be assigned to the Training Command. The remaining 63% will be assigned to various other air shore activities such as the Navy Department, Naval Air Stations, etc. Certain officers will have an opportunity to attend one of the service colleges. Schooling and other postgraduate training will continue to be available. Those officers who have previously attended school will be ordered to duty allied to their postgraduate training.[2]

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[2] Ibid, page 8-30.

Here again it is most probable that a naval aviator will be assigned to a "proficiency billet" with the ensuing erosion of his very costly abilities. Cost wise, even the required facilities for proficiency flying are becoming increasingly prohibitive in money and manpower costs.

The Advanced Operational and Command Development Phase cannot be spelled out in detail. However, the Career Chart of the Officer Fact Book (See Appendix A) indicates that one half of this period will be spent in an operational billet.

From this outline of a typical Striking Force naval aviator career pattern, the following fact is obvious; a naval aviator is in an operational flying billet a maximum of seven and one-half years out of the first fifteen years of his career. Recently the shortage of flying billets has reduced normal operational flying tours to from five to six years total out of fifteen years.

STATEMENT OF THE PROBLEM

The question this paper will attempt to answer is, "Is the present naval aviator career pattern in consonance with the maximum state of combat readiness required for naval aviators manning Attack Carrier Striking Force Aircraft? And, if it isn't, to suggest some possible improvements to these career patterns." In other words, "does the 'well-rounded' naval officer concept remain compatible with the readiness requirements of the Carrier Striking Force naval aviator?"

CHAPTER II

THE PRESENT STATE OF THE ART AND PROBLEMS ASSOCIATED WITH SUPERSONIC AIRCRAFT

MANNED AIRCRAFT OR PILOTLESS MISSILES

Before proceeding further let us take a look at future requirements for manned aircraft. To dispel a popular idea that missiles are making manned aircraft obsolete consider the following statements:

"Thus we come to the factor of human judgment. I have been discussing this with my friend, Major Alexander J. De Seversky, one of our foremost aeronautical experts.

Sasha emphasized that robot missiles have 'no power of choice' and he went on to make a provocative point, which he also expressed in his latest book, "'America - Too Young to Die.'"

It is inevitable that one side or the other, or both, will develop anti-missile defenses. In that case it is quite probable that a supersonic manned airplane - with its cargo of human brains and human judgment as well as weapons - could become the ONLY weapon capable of penetrating complex defense systems. By military paradox, it would supersede in importance the non-thinking, fixed trajectory ballistic missile."

George Carroll, aviation editor of Hearst Headline Service, has come up with a couple of other pertinent quotes:

One was by Sir Roy Dobson, managing director of the Hawker Siddeley group of British planemakers, to Royal Air Force cadets:

"In an age of complex, electronic weaponry, nothing yet can replace human judgment. No electronic device can equal the human brain, capable of thinking for itself and interpreting changes of situation instead of merely conforming to preconceived pattern."

The other is by Scott Crossfield, North American test pilot and ONE OF THE FLIERS WHO SAVED OUR 4,000 MPH X-15 RESEARCH PLANE FROM FAILING ON 24 OF ITS 48 MISSIONS. Speaking of a human being at the controls of a plane or spacecraft, he asked:

"Where else would you get a non-linear computer weighing only 160 pounds, having a billion biniary decison elements, that can be mass produced by unskilled labor?"

With that witty and searching question, I rest my case.[3]

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[3]Editorial in the San Francisco Examiner, March 18, 1962.

From these statements by eminent aeronautical authorities we can deduct that the manned aircraft is not in danger of becoming obsolete. It is also obvious that the aircraft of the future, to accomplish the strike mission, will probably be larger, capable of attaining extremely high altitudes, and will be equipped with ultra-sophisticated systems such as electronic counter-countermeasure devices. Even the present low altitude run in under the radar envelope will be eliminated with the advent of space satelite radar observation platforms. This trend is supported by present aircraft model trends. One piece of ground support equipment for the F4H (Phantom II), is nearly as large and is more intricate than World War II fighters!

A COMPARISON OF THE F6F-5 WITH THE F11F-1 AND THE F4H-1

Now let us consider some of the present Navy strike aircraft. As a starting point I include excerpts from an excellent study done by the OPNAV/BUPERS Personnel Monitoring Group in 1958. Bear in mind that the F-11-F has now been relegated to the Advanced Training Command and is no longer an operational aircraft:

F6F-5	F11F-1	F4H-1
	First Service Use	
1944	1957	1961
	Mission	
Destroy enemy aircraft	Destroy enemy aircraft	Primary - destroy enemy aircraft Secondary - Medium range strike & recco.

F6F-5	F11F-1	F4H-1
	Type	
Single-seat carrier day fighter	Single-seat carrier day fighter	Tandem two place (pilot & radar operator) carrier All weather day or night fighter
	Description	
Catapult & arrested landing provisions	Catapult & Arrested landing provisions	Catapult & arrested landing provisions
Manual flight control	Control about all three axes by irreversable hydraulic actuated surfaces, with artificial "feel".	Control about all three axes by irreversable hydraulic actuated surfaces, with artifical "feel". Has drogue chute provisions for field operation.
1500 p.s.i.	Two continuously operating indepen-3000 p.s.i. systems of equal power supply to tandem cylinders.	Three continuously operated high pressure systems with a "pop-out" ram air turbine and penumatic accumulators as emergency back up systems.
Mechanical trim-tabs	Longitudinal control by all-movable stabilizer when flaps are up & augmented by geared elevator when flaps are down.	Longitudinal control by all movable stabilizer.
	Lateral control by flaperons.	Lateral control by spoiler-flaperon type action.
High lift devices are slotted flaps	High lift devices are slotted flaps and leading edge slats.	High left devices are leading & trailing edge flaps & boundary layer control.
		Variable area engine ducts effected by ramps, controlled by CADC (Central Air Data Computer)
	In-flight Refueling	
None	Nose boom transfers 4000 pounds +.	Shoulder boom capable of refueling both internal and external fuel.

F6F-5	F11F-1	F4H-1
	Pilot Safety	
Parachute	Parachute	Parachute
Oxygen	Oxygen	Oxygen
Armor	Armor	Armor
	Pressurized cockpit	Pressurized cockpit
	Pressurized suit	Pressurized suit
	Ejection seat	Ejection seat
	Crash helmet	Crash helmet

The cockpit pressurization system in the F11F and the F4H is required to automatically heat, cool (using refrigeration), ventilate, and pressurize the cockpit using bleed air from the engine compressor. By contrast, the F6F required only ambient air heated by a simple surface combustion heater.

F6F-5	F11F-1	F4H-1
	Weights	
Empty - 9,240 pounds	Empty - 13,000 pounds +	Max. catapault take off weight 53,300 + pounds
Combat - 12,740 pounds	Combat - 18,500 pounds +	
	Power Plant	
Piston - propeller	Turbo - jet with after burner	Two Turbo-jets with after burners
	Fuel (Internal)	
1500 pounds	6,000 pounds +	12,000 pounds +
	Ordnance	
Guns	Guns	Sparrow III
Rockets	Rockets	Sidewinder
Bombs	Missiles	Special Weapons
	Armament Control System	
Illuminated Gun Sight MK.8	Ranging radar Aircraft Fire Control System	Radar capable of search, acquisition, attack & mapping with integrated automatic fire control system.

F6F-5	F11F-1	F4H-1
	Communications	
Two equipments	Two equipments	Multi-equipments
	Navaids	
One equipment	Three equipments	Multi-equipments
	Radar and IFF	
One IFF	Three equipments (in addition to other radar)	Multi-equipments
	Electrical	
Four equipments	Six equipments	Multi-equipments
	Compass and Autopilot Systems	
Compass	Compass	Sophisticated compass system with integrated Nav System
	Flight System	
None	Yaw Damper System	Yaw damper system-autopilot system

NOTE: For further examples of F4H technical complexity see a sampling of F4H pilot kneedboard flip cards in Appendix B.

The F8U and the A3D both lie somewhere between the F-11-F and the F4H in technical complexity. The A4D is unique in that it is one of the few existing operational aircraft that have resisted to a certain degree the trend toward ultra sophistication.

To approach this same area from a slightly different tack - the cost of the F3F of pre-World War II was $50,000 whereas the latest fighter in our stable, the F4H, comes off the production line with a cool two million dollar price tag! The speed of the F3F was 300 knots, straight down; the F4H Mach Two plus. The operating altitude, max, of the F3F was 18,000 feet, while the F4H operates straight and level above 60,000 feet and has accomplished just under 100,000 feet. Mission time for the

F3F was about seven hours; normal cycle time for the F4H is about three hours. But perhaps the most important and pertinent fact to us is, that in a given inflight emergency, the ratio of emergency knowledge required by the pilot of these two aircraft is on the order of 1:20. The pilot of today's aircraft must know twenty times as much about an infinitely more complex machine.

TRANSONIC AND SUPERSONIC PROBLEMS

Modern jets are plagued with problems due to their transonic and supersonic capabilities. Present jets are designed essentially for high performance at high altitudes, with a relatively high ratio of thrust, especially with use of afterburner. This power available can push the airplane past its designed speeds, and at low altitude, when the airframe design limits are exceeded, it is then in the "unglue" area. Recently an F4H in a high speed low altitude run completely disintegrated in a little over two seconds.

One characteristic helps warn the pilot of nearing that danger area: the effectiveness and sensitivity of the control system increases as the altitude decreases and speed increases--because lift is directly proportional to the density of the air.

Add to this near--limit speed/altitude situation the fact that the power controls are designed for sonic and supersonic speed control, and provide the pilot with large control in deflection with small physical effort. Result: The control surfaces are easy to move and hence it becomes easier to exceed the G-limit of the airframe.

Further, in many artifical "feel" systems, the "breakout forces" are often higher than the force required for further control, which

makes for a tendency to overcontrol, especially by the new pilot.

Such a combination is largely responsible for the PIO, Pilot Induced Oscillation, where, if the aircraft is at or near the limit of the flight envelope, a gust or turbulence can precipitate the "JC" maneuver.

Results of such encounters may cause immediate damage or possibly incipient damage which may not be noticed, but which may pay off in trouble later. Hence the necessity for the pilot to know the low altitude flight envelope and the penalties for exceeding limits.

AEROELASTICITY PROBLEMS

Penalties result from the aerodynamic effects of high speed; either a pure mach effect or from high Indicated Air Speed:

Aeroelasticity occurs because the aircraft is not a perfectly rigid body but bends and deforms under aerodynamic loadings. Early aircraft development to overcome this often consisted of a "try and see" process to establish structural limits. Some of the more prominent effects of Aeroelasticity are:

Fulselage bending occurs because of the increase in loading on lift surfaces at high speeds. As lift increases on the wings with speed, higher lift is demanded of the horizontal stabilizer to maintain level flight. Thus, at high speeds, if the fuselage permits, the fuselage will bend upwards due to the large "up" forces at each end. This causes an increase in the effective angle of attack of the wing and a reduction in the L/A of the horizontal stabilizer, which causes more forward stick to be required. This is less common on jet aircraft because of the relatively short fuselage which is further

strengthened by the engine installation, but conventional aircraft still favor a long fuselage and bending can often be present at high speeds.

Wing divergence is caused by abnormally high stress on the wing, and simply stated, means that the wings might snap off at high speeds because the aircraft was on the wrong side of the redline. This trouble is more common to straight wing a/c Factors involved are: wing torsional stiffness (twist resistance) and the distance between the center of twist and the aerodynamic center. A typical situation would be that of a high IAS, encountering a slight updraft from turbulence, which gives a slight uplift to the wing--to commence a lethally vicious cycle: (often occurring so rapidly as to appear a one-shot affair). The slight uplift produces a momentary increase in Lift; this causes the wing to deflect upward (twist); the L/A is further increased, which produces <u>more</u> deflection, more L/A and so on, with the process repeating instantaneously until wing failure and complete "divergence." At speeds below critical values this process of increments of lift becomes smaller until a condition of stable equilibrium is reached--which process the airplane will follow if the pilot has not pushed it into the redline speed zone.

The classic, and surprising example of the aileron reversal phenomenom is: In the redline zone, the pilot wishes to roll the airplane to the left; he applies left aileron--and the airplane bends around to the right! This is another function of the stiffness of the wing. Normally, at reasonable speeds, Lift on the "down" aileron wing increases:

lift on the "up" aileron wing decreases, and the desired roll moment is produced. At high speeds, however, the down aileron is subjected to high forces from the forward motion of the airplane, with a total force causing a twisting of the wing to twist the leading edge down and reduce the angle of attack. The "up" aileron produces a moment to increase the L/A on the opposite wing to reduce the desired rolling moment. Now the twisting moment varies as V^2, whereas the restoring torque remains constant with speed, so it is possible that as speed increases the rolling moment becomes less until a speed is reached when aileron deflection will not produce a rolling moment and beyond this speed the effect of the aileron becomes reversed. In a sense the deflected aileron becomes a "tab" which in turn deflects the wing as a "aileron" to decrease the desired roll performance. For example, in the F8U, at near sealevel, definite aileron reversal can occur above 650 knots. Thus the max speed restriction on the Crusader below 20,000' is based on aeroelasticity effects, with even more stringent restrictions imposed below 10,000'.

Note: Until the advent of high performance aircraft, particularly sweptwings, designers avoided this trouble by beefing up the wings--but if you build the a/c like an anvil, it will fly like an anvil. So, alternate ways were devised to produce a rolling moment, such as inboard ailerons, flaperons, spoilers and the like, all of which have their limitations also.

Destructive flutter has perhaps the most far reaching effect of aerodynamic phenomena on the design of high speed a/c. Flutter, or

"buzz" can occur on <u>any</u> of the aerodynamic surfaces, wing, fuselage or tail surfaces, but it can start on all of the control surfaces simultaneously. The trouble results from a high frequency oscillation of surfaces excited by the airstream at high speed. Flutter can be responsible for the loss of control surfaces, sections of paneling, and in some cases, large sections of tail assembly. In the past flutter was readily detectable by the pilot as he was connected directly with the control surfaces by wires, etc. Now he has no direct physical contact and hence is not as aware as before. Wing planforms and aspect ratios have significant effects on flutter characteristics. A decrease in wing aspect ratio and an increase in sweep tend to raise the flutter speed.

Due to the demands placed upon us by the progress of our potential enemies, the evolution of more advanced combat aircraft is a continuous process for which no end can be predicted as long as the enemy competition continues. As an example of the complexity that can be expected, it has been estimated, in general terms, that the complexity of electronic functions and equipment in combat aircraft increases as the square of the speed in the region above Mach 1.

Combat aircraft capable of operating at Mach 3 and in excess of 100,000 feet are close to the test model stages at the present time!

CHAPTER III

EDUCATION AND TRAINING REQUIREMENTS

EDUCATION REQUIREMENTS

In addition to the basic Bachelor of Arts courses desirable in present educational curricula, at least a working knowledge of the following courses are a requirement for the strike aircraft naval aviator if he is to utilize his aircraft to the utmost of its capabilities. These courses will be arranged by aircraft major component systems and some duplication will therefore occur.

<u>Airframes</u>

Physics (including Mechanics, Stress Analysis & Nuclear Physics)
Aerodynamics
Hydraulics
Chemistry (including Metallurgy and Plastics)
Mathematics (including Calculus, Operations Analysis & Computer Orientation)
Electricity
Electronics

<u>Power Plants</u>

Engine Theory
Chemistry (oriented in fuels and lubricants & Metallurgy)
Mathematics

<u>Airborne Systems</u>

Electronics (including radar, CM, ECCM and Navigational systems)
Chemistry (oriented in propellants, explosive warheads and nuclear devices)
Mathematics (oriented around computer integrated weapons delivery systems)

<u>Avionics</u>

Electricity
Electronics (oriented around radar, communication and navigational systems)

Note: In a recent Naval Postgraduate School lecture an Electronics Professor stated that to keep abreast of the developments in the electronics field today, a person would have to spend 30 to 40 percent of his time reading the latest technical reports and developments!

Although the strike aircraft naval aviator need not be master of all the above listed areas he certainly must have a good working knowledge of them that will enable him to comprehend pertinent developments as they apply to him. These areas are, of course, in addition to the normal knowledge and skill areas required of the naval aviator!

TRAINING REQUIREMENTS

In recognition of the need for specialization and economy the Naval Air Training Command has split its thru-put into various pipelines (single-engine, multi-engine, VA, VF, VP and ASW). The excellence of the pre-designation training of a naval aviator requires no testimonial. After the Training Command training, requirements fall into three major categories:

Familiarization

The naval aviator must not only initially become familiar with the systems peculiar to the model aircraft which he is flying but, if he is to remain a "professional", he must be continually reviewing these systems.

Instruments

Above and beyond normal VFR day, night, and carrier operations, the acquisition and maintenance of the highest level of instrument flight proficiency requires a considerable amount of a naval aviator's efforts. A minimum of 10 hours, either actual or realistically simulated, instrument flight time per month is highly desirable.

Weapons Delivery

The "pay-off" training requirement is, of course, weapons delivery.

Up to 50 percent of normal operational flight time will be spent in this training.

To be proficient and "Combat Ready" in these three areas a strike pilot should fly 50 hours per month. (50 hours desired, 30 hours minimum). A typical F4H 2-1/2 hour flight should require the following: 2 hours flight planning, 2 hours briefing and debriefing, up to 1 hour suiting-up (pressure suit), manning, and deplanning. Thus the strike pilot would be occupied 150 hours per month in flight and flight related activities. Add to this a nominal 1 hour per day ground training and 1 hour for collateral duties and we find that this totals out to 200 hours per month. In a 25 work day month the pilot would thus be occupied 8 hours per day! These then are the training requirements of a "professional" strike naval aviator to remain "combat ready!"

To re-emphasize these requirements consider the following comments:

"A complete knowledge of the capabilities and limitations of his aircraft is mandatory for every pilot. We are flying planes today that can exceed their maximum allowable airspeed in straight and level flight. What happens then--directional control is lost; try a roll and inertia coupling sets in and they just don't build them to fly sideways.

Or take the case of the nugget who takes off in afterburner and accelerates so rapidly that he is in a high "q" region (going like a bat at low altitude). If it is a slightly turbulent day the setting is right for a PIO (pilot induced oscillation), JC maneuver or what have you. It happened, and not knowing how to recover our boy ejected. Down the drain goes $7,000,000 worth of brand new airplane--not because of any material malfunction or failure but because the pilot was not familiar with the aerodynamic characteristics of his airplane.

If we pursue this line of reasoning to combat tactics we find that the pilot will not obtain maximum combat effectiveness from his airplane because he does not fully understand its capabilities and limitations. Any future combat will undoubtedly require that we get maximum performance from our pilots and aircraft.

The need for having personnel in the fleet who have a background

in aeronautical engineering is becoming every more apparent. Technical advances in aircraft and equipment are progressing rapidly. We sat with guns at Mach .8-.9 for a long time. Now we are on the threshold of Mach 2 plus weapons systems.

We cannot afford to stumble along as stick and throttle jockeys. With a decrease in squadrons and air groups and the spiralling cost of aircraft we must maintain every organization in a state of top combat readiness. This can be done only if every pilot is a well trained professional aviator.[4]"

THE PATH TO PROFESSIONALISM

How then does a pilot become a well trained professional aviator? The first step, of course, is fulfilling the educational requirements previously described in this chapter. The second step is completing the Naval Air Training Command Syllabus. The final step in attaining professional status is accomplished in the initial operational tour. If this professional status is to be maintained it will require constant retraining and review. New weapons, techniques, and developments must be mastered and applied as they appear. Modern Carrier Naval Aviation cannot brook widely spaced, sporadic aviator career patterns. It demands constant application if the striking force naval aviator is to remain "professional" and our Naval Striking Forces can afford nothing less than a "professional!"

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[4]CDR Paul (n) Miller, JR., USN, "Stick and Throttle Jockey?--Not Enough!" (Monterey California: United States Naval Postgraduate School, 1961), p. 1. (Mimeographed).

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

From the facts and discussion set forth in Chapters II and III it is felt that the present career pattern for strike aircraft naval aviators is not in consonance with the high standards of "combat readiness" and "professionalism" that must be maintained. Although the present Replacement Air Group training is an excellent means of retraining the strike naval aviator before reporting to the operating squadron it is not enough. This type of flying has become a vocation rather than an avocation! As such it requires the constant and continuing application of all faculties of the Strike Naval Aviator rather than the present sporadic exposure.

RECOMMENDATIONS

It is recommended that a program developed along the following lines be adopted for strike naval aviators:

<u>Source</u>

Candidates should be selected from highly motivated high school graduates or comparable sources.

<u>Training</u>

Academic training should be standardized in the areas noted in Chapter III with sub-specialization in one of the four major aircraft component fields. This training would be obtained at either an accredited civilian educational institution or at one of the present "in-service" educational facilities. Normal flight training would follow this academic

training.

Service composition and length

Upon completion of flight training, which would include the present Replacement Air Group training, the strike naval aviator would report to a fleet squadron where he would be quickly integrated and brought to maximum "combat readiness". Here he would remain for a period of 10 to 12 years, maintaining at all times maximum "combat readiness." If any rotation is desired during this period it could be to the Replacement Air Group as an instructor or to an equivalent billet. Maximum non-operational tours should be limited to from six to ten months for advanced educational purposes as required. While in an operating squadron he would be assigned, as much as possible, to collateral duties in his sub-speciality area and when not so assigned would be required to keep abreast of developments in that area.

End service period procedure

At the end of the 10 or 12 year period the strike naval aviator would indicate to the Bureau of Personnel his desire as to retention or release. Upon review of the individual's record of performance and recommendation from the squadron C.O., BuPers would determine whether to retain the individual officer or to release him. If retained, the officer, now in a permanent career status, would be ordered to such schools as deemed necessary to prepare him for command and higher responsibilities. The Navy would of course have the option of retaining those wishing to be released, if service requirements made

this necessary. To those officers being released the Navy would pay a "lump sum" settlement, possibly $25,000; this payment would end all obligations with the exception of a "National Emergency" obligation of the individual officer.

PROGRAM ADVANTAGES

The first advantage is of course in the source region. High caliber high school graduates are more maleable and far better motivated than more mature college trainees; and there are more of them! The present trend in industry is to select promising young trainees and give them the necessary education to fit the organization. The scientific education would be costly but would be a good investment in either the case of retention or release. Those who have served as instructors in Flight Training will readily support the higher motivation factor for high school graduate level trainees.

Secondly the scientific education and sub-specialization would have advantages in areas other than flying. Squadron training would be much easier and more effective because of the homogeneous grouping (such grouping doesn't exist now). No longer would a sharp enlisted man be working for a division officer who knew little or nothing about his technical specialty; thus morale and maintenance problems could be fewer. If released, the individual officer could easily take a parallel position in the civilian economy and be of benefit there. Those officers retained would of course be specialists, but "specialist" is no longer a dirty word in military circles. An excellent definition of the general officer or flag rank officer, is a "specialist who is broad enough and intelligent enough to encompass all related fields." These are the

officers that would be retained.

Another distinct advantage would be the certainty of the program. No longer would the young officer be plagued by the question "Where am I going next year?" A man cannot control his future but he is certainly happier if he is secure in some knowledge of it! He wouldn't be wondering if he were being ordered to sea duty, he'd know and would adapt to this fact. The longer tour length would also allow some planning and permanency.

The recruiting advantages of this type of program are outstanding. The proposed "lump sum" settlement would be very attractive in this materialistic age. It would allow the released officer adequate funds to enter a field of his choice and with a considerable amount of financial independence. Realism requires recognition of the fact that the type of officer that is desired would be earning, on the average, twice as much money as his Navy pay in civilian industry. Also in civilian industry he would have considerable more freedom than the rigors of military discipline can allow. These points may seem insignificant but it must be realized that we are in constant competition with civilian industry for our officer complement. This fact is painfully apparent as it becomes increasingly more difficult to retain outstanding young naval aviators.

The "lump sum" settlement for the officer desiring release and the retention selection for the officer desiring to stay would both provide excellent motivational factors. The retention seeking officer would be

striving to assure his selection for retention. The release seeking officer could not afford slipshod performance with its attendant danger of early separation which would cause forfeiture of the "lump sum" payment. This would avoid the present possibility of an officer reaching retirement status purely by virtue of having done nothing "wrong"! The release costs seem large at first but consider that $25,000 is equal to under seven years of a Commander's retirement pay; to say nothing of his active duty pay to retirement. These costs would be offset to a great degree by the decreased requirements for "proficiency flying" hardware and facilities. These costs would also be known fixed costs, not variables, and, as such, would be easier to consider in fiscal planning.

The last and most important advantage would be the fact that the "combat readiness" of our strike naval aviators would be maintained at maximum level continuously. This is a requirement that we must meet!

This program is not new. The Hobb's report recommended a part of it in 1959. The Army and Air Force have adopted similar programs for specialists. The British Government has effected a similar program in all military branches (see Appendix C).

With increased technical complexity the key-note of today's Navy, we continue to insist that unrestricted Line Officers be required to master every facet of their career and be thoroughly versatile in meeting requirements of a tremendous range of technical, planning and operational billets. This practice was suited to the limited technical and operational developments of navies of the past but must result in dilution of leadership in future navies where the exercise of strong leader-

ship and the maintenance of professional proficiency by officers demand the reduction of the present span of cognition required of them. As the requirement for depth of knowledge, experience and proficiency in a given field is intensified, the breadth of that field must be narrowed to accommodate human limitations. He who loses the ability to adapt soon ceases to exist!

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APPENDIX A

AVIATION DETAILING

Aviation assignment patterns are designed to give the naval aviator (code 13XX officers) necessary command qualifications for aircraft units and those ships primarily associated with aviation units, as well as to develop the naval aviator's technical capabilities for peace or war. Professional development to accomplish the above is set forth in Sections 831 through 836. Additional valuable information, pertaining to the assignment and rotation patterns of code 13XX officers, is periodically issued by the Officer Distribution Division of the Bureau of Naval Personnel in the "Line Officer Personnel Newsletter." This information should be disseminated to all code 13XX officers within the command.

FACTORS AFFECTING ASSIGNMENT PATTERNS, CODE 13XX OFFICERS

In addition to the general factors set forth in Section 804 the following factors influence career patterns and duty assignments during the active duty period:

a. Decentralized Detailing - In order to provide greater flexibility in meeting fleet needs for other than squadron command and shipboard billets, COMNAVAIRLANT, COMNAVAIRPAC, and CNATRA have delegated authority to modify "for further assignment" (FFA) orders to indicate an ultimate duty station for designated naval aviators through the grade of lieutenant commander who are ordered to their respective commands. This delegated authority does not extend to naval aviation observers, code 135X officers, limited duty officers and warrant officers associated with the

aeronautical organization.

b. Varied Shore Duty Assignments - Shore duty assignments provide the naval aviator with a variety of experiences in the field of schooling, instructing, air developmental experimentation, and administration. During shore duty assignments, an aviator has the opportunity to broaden his experiences so that he can fill managerial and planning billets in the Airshore Establishment in the latter phases of his career. Aviators will normally be assigned a duty tour in the Training Command at least once during their career.

c. Varied Sea Duty Assignments - Sea duty assignments give the naval aviator ample opportunity to develop the operational background necessary for eventual command assignments. Insofar as practicable, an attempt is made to give officers tours of duty in both the Atlantic and Pacific Fleets so that they will become familiar with the varied operational requirements of each fleet and broaden their geographical background. A code 1310 officer should expect at least two tours of duty aboard ship as a ship's officer. Tours in Air Transport Squadrons (VR) are normally of 30 to 36 months duration and offer opportunity to gain valuable all-weather, logistic, and airmanship experience.

d. Sea/Shore Rotation - In an effort to achieve greater stability in the fleets and the Air Shore Establishment, officers of the grades of Lieutenant Commander and below have been phased into a four year sea duty tour and a three year shore duty tour. In the grades of Commannder and senior, tour lengths are varied as necessary to round out an individual's qualifications and to meet the needs of the service.

e. Special Abilities - Special abilities can lead to the assignment to staffs in the fields of special weapons, training, operations, personnel, and so forth.

f. Special Qualification Assignments:

1. LTA. Officers dually qualified, LTA and HTA, will normally rotate between these duties. In some instances, the rotation might occur on a single split sea tour.

2. Helicopter - Naval aviators qualified in helicopters normally spend only one tour in this type of flying unless the officer is subsequently placed in command of a helicopter squadron or specifically requests reassignment on his Officer Preference and Personal Information Card.

g. Changes in Qualification - Those officers selected for jet squadrons who are not jet qualified will be ordered via the appropriate RAG squadrons to obtain the qualification. The eventual assignment to an operational squadron is determined by the Force Commander and is made on the basis of fleet requirements.

h. Command Tours - Squadron command assignments are normally made for one training-development cycle. Ship commands are for 14-18 months.

i. Desires of the Individual - The desires of the individual, such as requests for schools or extension of tours, are normally granted providing there is no conflict with fleet requirements. Desires should be indicated on the Officer Preference and Personal Information Card.

j. Distribution of 1100 and 1300 Officers - Aviation officers approximate non-aviation officers (unrestricted line) in overall numbers.

Additionally, the continued growth and large-scale employment of naval aviation in support of our nucleonic, electronic and supersonic Navy will demand the fullest expression of naval aviation knowledge and experience in all naval administration and planning. OPNAVINST 1301.3 series sets forth policies and prescribes certain measures for the continuing closer integration of naval aviation within the Navy. These policies, in general, affect the allocation of 1100 and 1300 billets in the grades of commander and above.

TYPICAL CAREER ASSIGNMENT PATTERNS, CODE 1310 and 1350 OFFICERS

Typical career assignment patterns are depicted in Figures 8-6 and 8-6a for code 1310 officers, and in Figure 8-7 for code 1350 officers.

a. Code 1310 Officers - The career pattern for code 1310 officers is based on a systematic progression of duty assignments designed to develop in the individual officer the highest standards of professionalism as a naval avaitor while at the same time providing sufficient shipboard, staff, administrative, technical and educational experience in order to qualify the aviation officer for the various levels of naval command.

1. First Operational Phase - Upon designation as a naval aviator, virtually 100% of the officers are assigned to fleet operational squadrons for a four year tour. This first sea tour is a critical period of development as it is during this time that the young officer develops his reputation as a professional highly skilled, operational

naval aviator. Squadron and shipboard collateral duties provide the young naval aviator the opportunity to acquire the essential non-flying qualifications required of all junior line officers.

Attack Carrier pilots may expect an uninterrupted tour in order to acquire a maximum degree of experience in squadron tactics, administration, fleet deployment and shipboard operations. ASW pilots, where possible, will be given a split tour, alternating between land and water based multi-engined aircraft and carrier-based VS squadrons. This will enable them not only to acquire the maximum experience in ASW operations, but also to acquire an intimate knowledge of shipboard operations. These split tours will be confined to Regular officers and those Reserve officers who are so motivated and recommended by their commanding officers.

2. Professional and Technical Education Phase - Aviators coming ashore after their initial sea duty tour should be serving in the grade of Lieutenant. Approximately 74% of the officers rotated ashore will be assigned to the Training Command, General Line School, and Colleges, either as instructors or students. The remaining 26% will be assigned to aviation activities of the Shore Establishment. The majority of billets in the training command are operational flying assignments thereby providing maximum opportunity for an aviator to enhance his professional skill.

For many officers, the first shore tour will be split. Part of the tour will be spent in one of the school programs, i.e., postgraduate, 5-term, or General Line School, while the remainder will be spent as an instructor in the Training Command.

3. Second Operational Phase - Up to 62% of the officers going to sea for their second sea duty assignment will spend the entire tour in an operational flying assignment. The remaining officers will be given a sea tour which will be split between a flying billet and a ship, staff, and/or overseas billet. In many cases, a third sea tour will be commenced before the officer enters the Advanced Operational and Command Development Phase (Sub para. e.). This third tour also will be split tour for the majority of officers.

4. Advanced Educational Phase - During this tour approximately 37% of the officers will be assigned to the Training Command. The remaining 63% will be assigned to various other air shore activities such as the Navy Department, Naval Air Stations, etc. Certain officers will have an opportunity to attend one of the service colleges. Schooling and other postgraduate training will continue to be available. Those officers who have previously attended school will be ordered to duty allied to their postgraduate training.

5. Advanced Operational and Command Development Phase - During this period, aviation officers receive major qualifying assignments, i.e., squadron command, air group command, and ship billets. Commencing with this period there is no schedule for sea/shore rotation, such rotation being dependent upon the needs of the service and the career needs of the individual for assignments of greater responsibility leading to higher command. In addition to the command and ship tours, there are opportunities in this area for aviation officers to increase their professional background through attendance at services colleges

and through serving in planning and policy assignments in joint and combined staffs, the Navy Department, and other governmental activities.

GRADE NOW	GRADE *	YRS	PERIOD	PHASE		ASSIGNMENT AREAS	
ENS	ENS	1	FUNDAMENTAL PROFESSIONAL DEVELOPMENT	SEA	First Operational	OPERATIONAL SQUADRON Division Officer Assistant Department Head USNA, NROTC, OCS Grads - 18 Months' Flight Training Then Designated 13XX. Such Officers will be as much as 18 Months Behind Indicated Pattern	
ENS	ENS	2					
LTJG	ENS	3					
LTJG	LTJG	4					
LT	LTJG	5		SHORE	Prof & Technical Education	TRAINING COMMAND	GENERAL LINE SCHOOL FIVE TERM (NACP) POSTGRAD SCHOOL
LT	LTJG	6					
LT	LT	7					
LT	LT	8		SEA	Second Operational	OPERATIONAL SQUADRON Assistant Department Head Department Head	SPLIT TOUR SHIP/STAFF OVERSEAS BASE
LT	LT	9					
LT	LT	10					
LCDR	LT	11					
LCDR	LT	12	BEGINNING OF ADVANCED PROFESSIONAL DEVELOPMENT PERIOD (See Fig. 8-6a)				

*Title 10, U.S. Code

TYPICAL CAREER ASSIGNMENT PATTERN FOR CODE 1310 OFFICERS

LTs and Below

Fig. 8 6

GRADE NOW	GRADE *	YR	PERIOD	PHASE		ASSIGNMENT AREAS	
LCDR	LT, LCDR	12, 13, 14	INTERMEDIATE PROF. DEVELOPMENT	SHORE	Adv. Educ.	TRAINING COMMAND	AirShore (NAS, USNA, Navy Dept., etc.) P.G. Grads to Sponsoring Activity Five Term/General Line School Junior Service College
CDR	LCDR, CDR	15, 16, 17, 18, 19, 20		Sea & Shore tours varied to round out quals & meet service requirements	Operational Command Development	OPERATIONAL SQUADRON Department Head XO CO CAG	SEA Split Tour: Ship/Staff/ Overseas Assignment SHORE: Planning & Administrative duties in the AirShore Establishment, R & D, Navy Department, NAS, Training Command, Schools, Senior Service College
CAPT	CDR, CAPT	21, 22, 23, 24, 25, 26, 27, 28, 29, 30	ADVANCED PROF. DEVELOPMENT		Advanced Development	SEA Intermediate & Major Command Staff Overseas Assignment	SHORE Planning & Management duties in OPNAV, BUREAUS, TECHNICAL OFFICES, R & D Commanding Officer of Shore Activities: NAS, Training Command Schools: Student, Instructor, CO

*Title 10. U.S. Code

TYPICAL CAREER ASSIGNMENT PATTERN FOR CODE 1310 OFFICERS

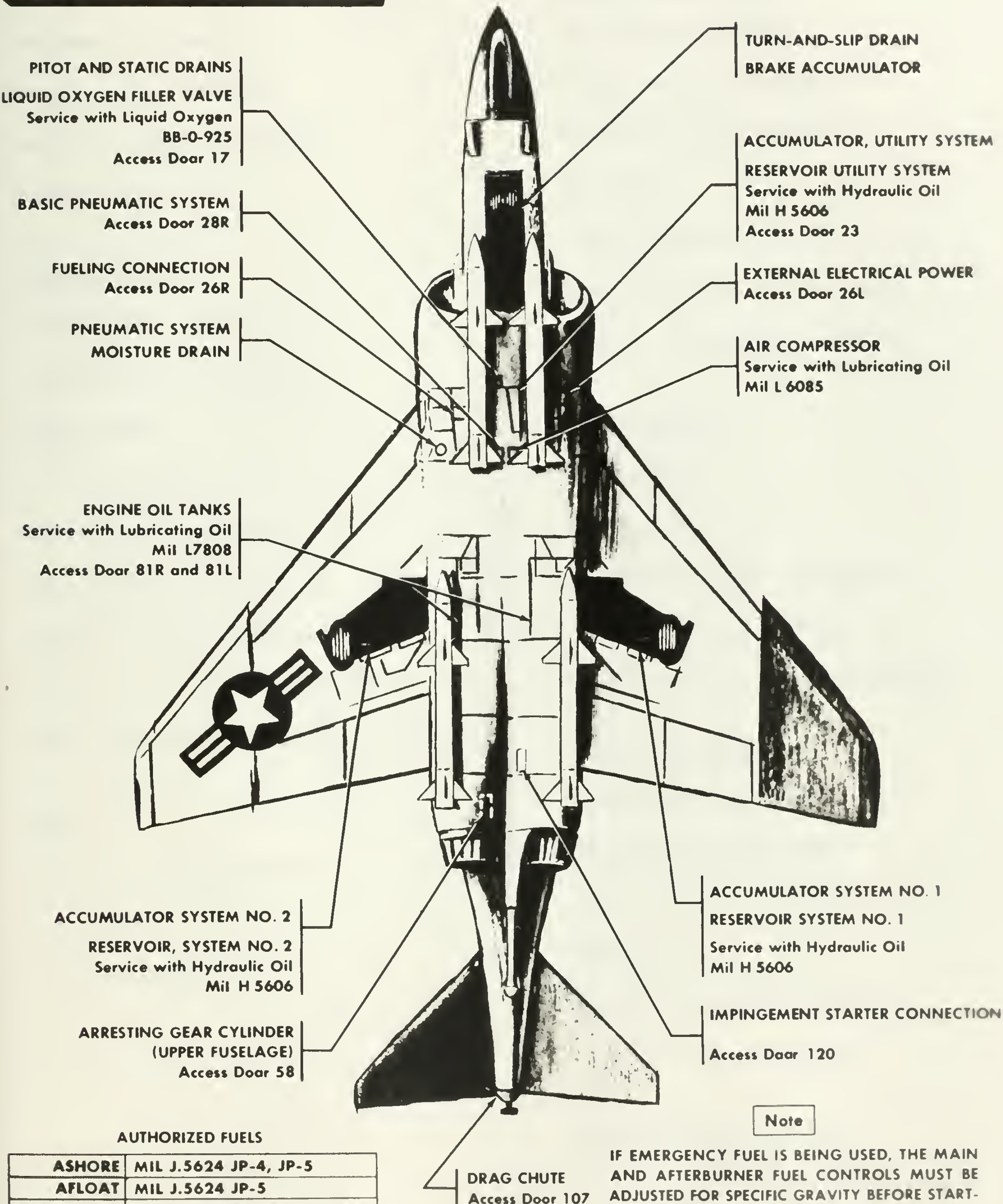
LCDRs and Above

Fig. 8 6a

APPENDIX B

SELECTED F4H PILOT KNEEBOARD FLIP CARDS

SERVICING POINTS



AUTHORIZED FUELS

ASHORE	MIL J.5624 JP-4, JP-5
AFLOAT	MIL J.5624 JP-5
EMERGENCY	MIL F.5572 AVGAS 115/145

Note

IF EMERGENCY FUEL IS BEING USED, THE MAIN AND AFTERBURNER FUEL CONTROLS MUST BE ADJUSTED FOR SPECIFIC GRAVITY BEFORE STARTING ENGINES.

PILOT WALK AROUND

NOSE

Refrigeration intakes clear

Radome secure, undamaged

Angle-of-attack cover removed

Intake duct areas clear

NOSE GEAR WELL

Tire condition, inflation

Strut extension and inflation

Shimmy damper

Gear doors secure

Brake accumulator 1500 psi

Emerg. flap bottle 2200 psi min.

Emerg. R. A. T. bottle 2200 psi min.

Emerg. M. L. G. bottle 2200 psi min.

Emerg. brake bottle 2200 psi min.

WING

Leading edge flaps undamaged

Skin condition

Jury strut removed

RIGHT WHEEL WELL

Tire condition, inflation

Strut extension and inflation

Over center spring condition

Gear doors

Ground fueling switch - off

Speed brake safety switch - normal

#2 P. C. S. accumulator - 1000 psi

AFT FUSELAGE

Skin condition

Nozzle areas clear

Stabilator and rudder undamaged

Arresting gear guard removed

Drag chute door - secure - no streamer

LEFT WHEEL WELL

Tire condition, inflation

Strut extension and inflation

Over center spring condition

Gear doors

#1 P. C. S. accumulator 1000 psi

#1 P. C. S. reservoir 2000 psi

UNDERSIDE OF FUSELAGE

Access door 17 - oxygen filler cap secure

Valve in build-up position

COCKPIT CHECK-OUT, START AND LANDING

PRE-START

1. Ejection seat - CHECK
2. Gear handle - DOWN
3. Flap handle - UP
4. Throttles - OFF
5. Generators - EXT PWR
6. Oxy - OFF
7. Emerg handles - CHECK
8. Intercom - CHECK
9. Fuel panel - CHECK
10. Fuel boost - CHECK
11. Eng de-ice - NORM
12. Eng masters - OFF
13. O2 Ind - PRESS TO TEST
14. Altimeters - SET
15. Fire warning - CHECK
16. Fuel quantity gauge - CHECK
17. Missile pwr - OFF
18. Arm master - SAFE
19. Missile jett - SET
20. Emerg vent - DOWN
21. Foot heat - SET
22. Pitot & rain - OFF
23. Radio - AS DESIRED
24. Circuit breakers - IN
25. Temp cont - AS DESIRED
26. Compass cont - SLAVED
27. Warning lites - TEST

START PROCEDURE

1. Master switch - ON
2. Eng start switch R or L
3. Ignition - 11%
4. Throttle - Idle 11-12%
5. Eng start switch - OFF at 40%
6. Eng inst - NORMAL
7. Repeat second engine

POST START

1. Gen switches - ON
2. Signal Ext Pwr - REMOVE
3. Wings spread and locked
4. Control surfaces - CHECK
5. Damper - ON
6. Trim - NEUTRAL
7. SPC - RESET

BEFORE TAKE OFF

1. Canopy - CLOSED
2. Trim - CHECK
3. Telelite panel - CHECK
4. Check engs alternately
5. Flaps - SET

TAKE OFF

1. Release brakes - both engs to Mil
2. A/B - AS DESIRED
3. Rotate to flying attitude - 135-140
4. Gear up - safely airborne
5. Flaps up - PRIOR 225 IAS

LANDING

1. Gear DOWN below 250
2. Flaps DOWN below 215
3. Pattern (3000#)

	BLC Full Flap	1/2 Flap
Downwind	180	180
Base	150	170
Final	130	135

4. Drag chute after touchdown
5. Flaps UP for taxi

EJECTION SEAT BAIL-OUT

1. Reduce speed if possible.

2. If at low altitude, pull up into zoom.

3. Alert R. O. to eject first.

4. Pull face curtain to stop.

5. After canopy leaves, pull face curtain again to stop.

If Canopy Fails To Jettison

1. Pull emergency canopy handle aft.

If Canopy Still Has Not Jettisoned

1. Place normal canopy lever to OPEN position.

2. Pull manual canopy unlock handle.

3. Push up on canopy and the slipstream will jettison it.

4. Pull face curtain.

* * * * * WARNING * * * * *

The alternate firing handle (located between knees) causes poor ejection posture and should only be used when it is impossible to reach the face curtain.

* * * * * WARNING * * * * *

If after bailout you are certain you are going to come down on land - pull up on the composite release and unfasten the two lower lap belt fittings. This will allow your seat pan to fall free. If you are wearing a pressure suit open your face mask before pulling up on the composite release.

ENGINE FAILURE DURING TAKE-OFF ROLL

TAKE-OFF ABORTED

1. Both throttles to CUT-OFF
2. Call for wire.
3. Deploy drag chute.
4. Wheel brakes applied.
5. Drop hook.
6. Engine masters OFF.

TAKE-OFF CONTINUED

1. Both throttles -A/B.
2. Lift off -170 IAS.
3. Gear -UP
4. Jettison external tanks.
5. Increase airspeed.
6. Flaps UP.
7. Failed engine, CUT-OFF
8. Failed engine master, -OFF.
9. Dump wing fuel.
10. Land as soon as possible.

ENGINE FAILURE DURING FLIGHT

1. Failed engine throttle to CUT-OFF.
   If failure can be corrected attempt airstart as follows:
   1. 12-16% RPM.
   2. Ignition ON.
   3. Advance throttle to idle detent.
   4. After light-off advance to desired RPM.
2. If failure cannot be corrected:
   1. Pick out closest useable airfield.
   2. Engine master - OFF, failed engine.
   3. Jettison external stores and wing fuel.
   4. Fly wide pattern.
   5. Use 1/2 wing flaps for landing.
   6. Make power landing.

SINGLE ENGINE APPROACH SPEEDS

# FUEL	IAS
2000	143
4000	147
6000	151

Rule Of Thumb: 145 IAS for 3000#, increase 2 knots every additional 1000#.

DOUBLE FLAME OUT

1. Throttles to CUT-OFF.
2. Extend ram air turbine.
3. Establish 230 IAS.
4. Start either engine.

If start is not successful within 30 seconds, abort and start other engine. This will allow the igniter to cool.

ENGINE FIRE WARNING DURING FLIGHT

1. Throttle idle on indicating engine.
2. Check for trailing smoke (in turn).
3. If smoke detected throttle OFF and engine master OFF.
4. If smoke still persists EJECT.
5. If light goes out after 1 above gradually increase RPM again. If light comes back on shut the engine down and make a single engine landing.

LOSS OF POWER CONTROL NO. 1 HYD. PRESSURE

1. The No. 2 power control system will supply all hydraulic requirements.

2. Reset master caution light.

3. Extend the ram air turbine (below 525 IAS).

   NOTE: Hydraulically there is no time limit for ram air turbine operation. Electrically the ram air turbine will overheat after 15 minutes of operation. However, both generators must fail before the ram air turbine's electric generator assumes a load.

LOSS OF POWER CONTROL NO. 2 HYD. PRESSURE

1. The No. 1 power control system will supply all hydraulic requirements.

2. Reset master caution light.

LOSS OF UTILITY HYDRAULIC PRESSURE

1. Rudder power, auto pilot, dampers and radar antenna will be inoperative.

2. MLG and flaps will have to be lowered by emergency air bottles.

3. Use manual braking (rudder pedals) during roll-out, and use emergency braking after accumulator is depleted.

COMPLETE LOSS OF HYDRAULICS

1. Extend ram air turbine.

2. If unable to maintain control over aircraft eject immediately.

3. If control is regained land as soon as possible.

PARTIAL BELLOWS FAILURE

Symptoms

1. Mild nose down stick force proportional to trim speed.

2. Reduced stick centering and gradient.

Action

1. Retrim as desired.

2. Avoid high speed flight.

COMPLETE BELLOWS FAILURE

Symptoms

1. Severe nose down stick force proportional to trim speed.

Action

1. Hold stick firmly to keep airplane under control.

2. Trim nose up until minimum stick force is obtained.

3. Avoid high speed flight.

4. Exercise extreme caution in fore and aft stick movements.

RUNAWAY FEEL TRIM

1. Check feel trim circuit breakers.

2. Hold stick firmly and engage auto pilot, if pitch oscillation occurs, auto-pilot will not retrim airplane and cannot be used.

3. If auto pilot retrims system, leave auto pilot engaged until in the landing pattern configuration then pull the appropriate trim circuit breaker and disengage auto pilot.

4. If auto pilot fails to retrim system, exercise caution during speed changes.

WINGS WON'T TRANSFER (No External Tanks)

1. Check "Int. Wing Trans. " switch in AUTO.

2. Place "Wing Trans. Press. " switch to EMERG.

WINGS WON'T TRANSFER (With External Tanks)

1. Place "Ext Transfer" switch OFF.

2. Check 1 & 2 above.

EXTERNAL FUEL WON'T TRANSFER

1. Check "Ext. Transfer" switch in correct position.

2. Place "Wing Trans. Press. " switch to EMERG.

EXTERNAL TANKS JETTISON

To jettison outboard and center tanks.

1. Press "Ext. Stores Emerg. Release". MLG handle must be UP.

To jettison wing tanks only.

1. Lift guard on "External Tanks" switch on fuel panel and place switch to JETT. MLG handle must be UP.

To jettison centerline tank only.

1. Place bomb control switch to "DIRECT" position and press pickle switch on stick. MLG handle must be UP.

DITCHING

Ditching the aircraft should only be done if there is insufficient altitude for a safe ejection.

1. Jettison canopy before water landing with emergency handle only.
2. After landing pull up on Emergency Harness Release Handle.
3. Unfasten parachute harness (upper) fittings.
4. You are now free to leave with the seat pan only.
5. Inflate life jacket when in water and pull up on the Pararaft Deployment Handle (aft right side of seat pan). This will deploy and inflate the pararaft.

ELECTRICAL FAILURE

f either generator fails, the other generator will handle the entire electrical oad as long as the bus tie remains closed

Nith a double failure involving a generator and the bus tie, the following ılectrical items will be inoperative.

LEFT GENERATOR FAILURE AND BUS TIE OPEN

1. The following items will be lost.

Engine Anti-Ice	Windshield Temp.
Fire Detector	Approach Light
A/B Ign., both engines	Fuselage Lights
Seat Adjust.	Equipment Cooling
#2 Hyd Press Ind	Missile Firing
Utility Hyd Press Ind	

RIGHT GENERATOR FAILURE AND BUS TIE OPEN

Aileron Rudder Interconnect	Aileron Feel Trim
Auto pilot	CADC
Heat and Vent	Eng Instruments
Eng Ramps	Fuel Quan.
CNI	Nav Computer
Oxy Gage	Radar Altimeter
Main Fuel Cont.	Landing Gear & Flap Pos. Ind.
Intercom	Nozzle Posit.
Pitot Heat	#1 Hyd Press
Pneu Press	UHF

DOUBLE GENERATOR FAILURE

Nith double generator failure extend ram air turbine.

ONLY the following major items are operative and then only above 195 IAS.

Instrument Lights	Warning Lights & Reset
Stab. and Ail. Trim	Intercom
Fuel Quantity	External Jettison
Ignition	#1 Hyd Press Gage
Eng Instruments	Pneu Press Gage
Gear Indicator	UHF
Static Correction	

ELECTRICAL FIRE

1. Generator switches - OFF.
2. All electrical equipment switches - OFF.
3. Generator switches - ON.
4. Turn back ON essential equipment and land as soon as possible.
5. If cause of fire cannot be found, extend ram air turbine, turn generators OFF and land as soon as possible.

WHEELS FAIL TO RETRACT

1. Check handle full UP and fully IN.
2. Check MLG circuit breaker.
3. Check utility hydraulic pressure.

WHEELS FAIL TO EXTEND

1. Check handle full DOWN.
2. Check MLG circuit breaker.
3. Check utility pressure.
4. If above does not lower gear, use emergency system as follows:
    a. Reduce airspeed to less than 250 IAS.
    b. Pull landing gear circuit breaker.
    c. Drop gear emergency - gear handle down and pull smartly aft.
    d. Check position indicators.
    e. If any one gear still does not indicate down and locked, use field arresting gear when shore based.

FLAPS FAIL TO EXTEND

1. Check flap circuit breaker.
2. Check utility hydraulic pressure.
3. Check airspeed below 215 knots.
4. Pull flap circuit breaker.
5. Lower flaps on emergency system by pulling emergency flap handle smartly aft.

HOOK FAILS TO EXTEND

1. Check hook handle full down.
2. Pull arresting gear circuit breaker (rear seat).
3. If hook still not down, call ship for instructions.

HOOK FAILS TO RETRACT

1. Check hook handle full up.
2. Check arresting gear circuit breaker (rear seat).
3. Check utility hydraulic pressure.

APPENDIX C

SCHEDULE OF CAPITAL PAYMENTS FOR ROYAL

NAVY OFFICERS ON PERMANENT COMMISSIONS

ANNEX I—ROYAL NAVY

OFFICERS ON PERMANENT COMMISSIONS

Examples of the special capital payments to Officers of the Royal Navy (and Royal Marine Officers of corresponding rank) with 10 or more years qualifying service, who come within the scope of this scheme, and, in addition, of the terminal grants in respect of their service, are shown below:—

Actual Age on Retiring	General List															Special Duties List			
	Captain over 6 years in the rank			Captain under 6 years in the rank			Commander			Lt. Commander			Lieutenant						
	Typical Terminal Grant	Special Capital Payment	Total	Typical Terminal Grant	Special Capital Payment	Total	Typical Terminal Grant	Special Capital Payment	Total	Typical Terminal Grant	Special Capital Payment	Total	Typical Terminal Grant	Special Capital Payment	Total	Typical Terminal Grant	Special Capital Payment	Total	
	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	
31										1,143	2,500	3,643	975	2,500	3,475				
32										1,188	3,000	4,188	1,020	3,000	4,020				
33										1,245	3,500	4,745	1,065	3,500	4,565				
34							1,537	4,500	6,037	1,305	4,000	5,305	1,110	4,000	5,110				
35							1,597	5,000	6,597	1,365	4,500	5,865	1,155	4,500	4,655				
36							1,657	5,500	7,157	1,425	5,000	6,425							
37							1,717	5,500	7,217	1,485	5,000	6,485							
38							1,777	5,500	7,277	1,545	5,000	6,545							
39							1,860	5,500	7,360	1,605	5,000	6,605							
40							1,950	5,500	7,450	1,665	5,000	6,665				1,132	5,000	6,132	
41							2,040	5,500	7,540	1,725	4,100	5,825				1,177	5,000	6,177	
42				2,400	6,000	8,400	2,130	5,500	7,630	1,785	3,200	4,985				1,230	5,000	6,230	Lieutenants
43				2,520	6,000	8,520	2,220	5,500	7,720	1,875	2,300	4,175				1,290	4,430	5,720	
44				2,640	6,000	8,640	2,310	5,500	7,810	1,875	1,400	3,275				1,350	3,860	5,210	
45				2,760	6,000	8,760	2,400	4,665	7,065	1,875	500	2,375				1,350	3,300	4,650	
46	3,000	6,000	9,000	2,880	6,000	8,880	2,400	3,830	6,230							1,350	2,740	4,090	
47	3,150	5,080	8,230	3,000	5,080	8,080	2,400	2,995	5,395							1,500	2,180	3,680	
48	3,300	4,160	7,460	3,000	4,160	7,160	2,400	2,160	4,560							1,500	1,620	3,120	Lt.-Commanders
49	3,450	3,245	6,695	3,000	3,245	6,245	2,400	1,330	3,730							1,500	1,060	2,560	
50	3,450	2,330	5,780	3,000	2,330	5,330	2,400	500	2,900							1,500	500	2,000	
51	3,450	1,415	4,865	3,000	1,415	4,415													
52	3,450	500	3,950	3,000	500	3,500													

Notes:—(1) The amount of the Terminal Grant depends on the circumstances of the individual case.

(2) The scaling down of the special capital payment at the earlier ages depends on the length of qualifying service.

(3) For purposes of illustration

(*a*) reckonable service from age 21, and 2 years in the substantive rank, assumed for General List Officers;

(*b*) promotion to the rank of Captain R.N. assumed to be at age 40;

(*c*) for Officers on the Special Duties List, 12 years service as a rating and promotion to Lt.-Commander at age 45 has been assumed;

(*d*) the figures for Lieutenants (General List) are based on the assumed career of an ex-Upper Yardman.

The special capital payments shown are those payable to officers who retire on attaining the ages stated. For officers who retire later an adjustment will be made of one-twelfth of any difference between this amount and the next amount for each additional month completed.

Officers will receive retired pay and terminal grant for service rendered in accordance with the normal rules, having regard to the nature of their previous service, with a minimum qualifying period of 10 years service.

Example 1

A typical *Captain R.N.*, if retired at age 42 with under 6 years in the rank and with 21 years reckonable service, will receive:—

Retired pay	£800 a year	
Terminal grant	£2,400	£8,400
Special Capital Payment	£6,000	

Example 2

A typical *Commander*, if retired at age 40 with 19 years reckonable service, will receive:—

Retired pay	£650 a year	
Terminal grant	£1,950	£7,450
Special Capital payment	£5,500	

Example 3

A typical *Lt.-Commander*, if retired at age 40 with 19 years reckonable service, will receive:—

Retired pay	£555 a year	
Terminal grant	£1,665	£6,665
Special Capital payment	£5,000	

Example 4

A typical *Lt.-Commander* (*Special Duties List*), if retired at age 47 with 20 years reckonable service, will receive:—

Retired pay	£500 a year	
Terminal grant	£1,500	£3,680
Special Capital payment	£2,180	

(Normally all these officers would receive the retired pay and terminal grant.)

Example 5

A typical *Lieutenant* (*Upper Yard-man*), if retired at age 33, with 12 years reckonable service, will receive:—

Retired pay	£355 a year	
Terminal grant	£1,065	£6,065
Special Capital payment	£5,000	

(Normally he would receive a gratuity of £1,400.)